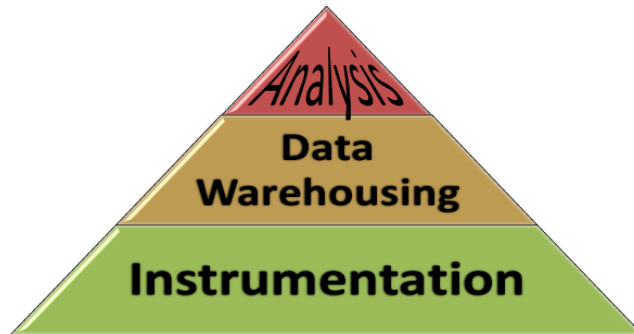


**A Short Course for the  
Oil & Gas  
Industry Professionals**

# SMART ANALYSIS & MODELING FOR THE SMART FIELDS

## Role of Artificial Intelligence & Data Mining (AI&DM) in Smart Field Technology

*A Comprehensive Course Designed for Petroleum Professionals focusing on smart field technology using the latest techniques and algorithms for integration of artificial intelligence and data mining with production and reservoir engineering.*



### **Course Description:**

This short course will cover the fundamentals of Artificial Intelligence and Data Mining (AI&DM) and will provide the theoretical background for its most used components such as artificial neural networks, genetic optimization and fuzzy logic.

The short course will then focus on several applications of this technology in smart fields including real-time data preparation for analysis, real-time well monitoring, real-time, adaptive well production modeling for proactive intervention, and closed loop, real-time reservoir management, etc.



**INTELLIGENT SOLUTIONS, INC.**





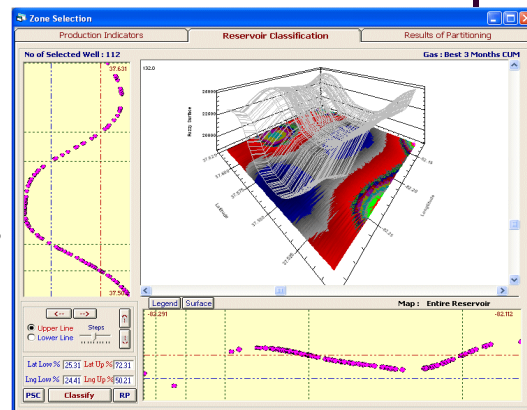
### Experience:

This short course has been taught successfully, numerous times as in-house training to national oil companies and to audiences from many major oil companies.

Artificial Intelligence is a collection of several analytical tools that attempts to imitate life. These tools (include but are not limited to, artificial neural networks, genetic optimization and fuzzy logic) are being used in many commercial products. They are used to provide smooth rides in subway systems, prevent fraud in the use of credit cards or to detect explosive materials during the airports check-in process. They are extensively used in the financial market to predict chaotic stock market behavior, or optimize financial portfolios. Their application in the oil and gas industry is relatively new. A handful of researchers and practitioners have concentrated their efforts on providing intelligent tools for the petroleum industry. Artificial intelligence and data mining tools have been used to Optimize Hydraulic Fracture Designs, Characterize oil and gas reservoirs, Optimize drilling operations, Interpret well logs, Generate synthetic magnetic resonance logs, Optimize new well placement, Select candidate wells for treatments and Predict post fracture deliverability. Use of AI&DM in smart completions, smart wells and smart fields is a natural continuation of this technology in the exploration and production industry. Smart fields without the use of AI&DM will not be more than a dream.

### *As a participants in the short course you are encouraged to bring:*

- Your laptop computer for hands-on practice of algorithms.
- Your own data. If you have data that you are currently working with, this is a great opportunity to bring your data to the short course and practice with these algorithms on your own data instead of using data that is furnished as part of the course material.
- Please contact ISI for data format.



Fuzzy pattern recognition applied to production data in mature fields, application: Mid Continent U.S.

### *Every participant in the short course will receive:*

- A Course Manual including all the slides used during the presentation of the short course.
- An electronic copy of all the slides.
- Electronic copy of technical material as support for the topics covered in the short course. This technical material takes you beyond the summarized slides and help you review in detail all you have learned in the short course.
- An evaluation copy of IDEA™ suite of software applications, the most comprehensive AI&DM tool for the Oil & Gas industry to be used during the short course.



## Course Outline:

### Part One: Artificial Intelligence & Data Mining (AI&DM); Theoretical Background.

#### Introduction

State-of-the-art in Artificial Intelligence and Data Mining (AI&DM)

#### Artificial Neural Networks

General Overview  
Biological Background  
Learning algorithms  
Transfer Functions  
Training, Testing and Verification data sets  
Dos and Don'ts of Neural Network Practices

#### Evolutionary Computing

General Overview  
Biological Background  
Genetic Algorithms

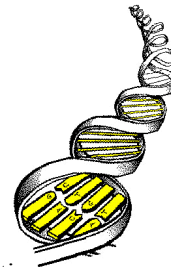
Fitness Function  
Genetic Operation  
Convergence

#### Fuzzy Logic

General Overview  
Fuzzy Set Theory  
Fuzzy Membership Function  
Fuzzy Decision Support Systems  
Fuzzy Rules  
Fuzzy Inference Engines  
Defuzzifications

#### Hybrid Intelligent Systems

Integrating Neural Networks, Genetic Algorithms and Fuzzy Logic



### Part Two: Smart Analysis & Modeling for the Smart Fields

#### REAL-TIME DATA PREPARATION FOR ANALYSIS

CLEANSING THE REAL-TIME DATA STREAMS  
SUMMARIZATION & ABSTRACTION OF THE REAL-TIME DATA STREAMS  
IDENTIFICATION AND MANAGEMENT OF OUTLIERS

#### WELL-CENTRIC REAL-TIME ANALYSIS

REAL-TIME WELL MONITORING  
REAL-TIME WELL TEST DETECTION & ANALYSIS FOR PROACTIVE INTERVENTION  
REAL-TIME, ADAPTIVE WELL PERFORMANCE MODELING & FORECASTING

#### REAL-TIME RESERVOIR ANALYSIS

REAL-TIME ANALYSIS OF DEPLETION MECHANISM  
REAL-TIME ANALYSIS OF MULTIPLE WELL COMMUNICATION  
REAL-TIME ANALYSIS OF FLUID MOVEMENTS IN THE RESERVOIR

#### REAL-TIME RESERVOIR MANAGEMENT

TOP-DOWN, INTELLIGENT RESERVOIR SIMULATION & MODELING  
SURROGATE RESERVOIR MODELING



### ABOUT THE INSTRUCTOR

**Dr. Shahab D. Mohaghegh** is professor of Petroleum & Natural Gas Engineering at West Virginia University and founder and president of Intelligent Solutions, Inc., the leading company in providing the oil and gas industry with solutions based on artificial intelligence & data mining (AI & DM).

With more than 18 years of experience, Dr. Mohaghegh has been a pioneer in the application of "AI&DM" in petroleum industry, applying hybrid forms of neural networks, genetic optimization and fuzzy logic to smart wells, smart completions, and smart fields as well as to drilling, completion, well stimulation, surface facility optimization, formation evaluation, seismic inversion, reservoir characterization, reservoir simulation and reservoir management.

He has published more than 100 technical papers during his career and has been a technical editor/reviewer for various SPE journals as well as other petroleum-related publications such as Oil, Gas and Coal Technology, Journal of Petroleum Science and Engineering, Computers & Geosciences, Geophysics, and Energy & Fuels. His technical articles on the application of "AI&DM" in the oil and gas industry and their recent developments have appeared in the Distinguished Author Series of SPE's Journal of Petroleum Technology during September, October and November of 2000 as well as the April 2005. He is a SPE Distinguished Lecturer for 2007-2008. He is an associate editor of SPE Reservoir Evaluation and Engineering Journal 97-99, & 2007- present. He has also served as chair, Steering committee member and discussion leader in SPE forums and has served as a steering committee member in SPE Applied Technical Workshops. He has been a panelist in several international conference discussing topics related to "AI&DM" and smart fields. He has served in U.S. Secretary of Energy's Advisory Committee on Unconventional Resources Technology in two administrations.

Shahab D. Mohaghegh holds B.S. and M.S. degrees in Natural Gas Engineering from Texas A&I University and Ph.D. in Petroleum & Natural Gas Engineering from The Pennsylvania State University.



### FOR MORE INFORMATION PLEASE CONTACT:

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